

Case Report

Poisoning of a Child Because of an Older Sibling's Habit

Urgent message: Be aware of new fads and habits that are growing in popularity. Some of them can result in life-threatening symptoms and serious permanent health consequences.

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Introduction

Vomiting is a common presentation in the urgent care setting, especially in the pediatric population. With children, health-care providers must start with a comprehensive differential diagnosis because of the difficulty in obtaining accurate information directly from the patient. The medical history, often presented by the parent, must be carefully sorted through for clues to a diagnosis. Information such as vomiting duration and frequency and associated symptoms can uncover any red flags. Other clues such as diet, dangerous environmental exposures, and risky behaviors of other family members can guide the diagnosis and eventual treatment.

Case Presentation

A 4-year-old boy presents to an urgent care center, accompanied by his mother, because of new-onset vomiting and a rapid pulse. The mother says that the child has vomited three times in the past hour but that the boy was “completely fine” beforehand.

A review of systems shows that he also has rhinorrhea, diarrhea, abdominal pain, and some shortness of breath. His mother reports that he has not had any seizures and has not exhibited an altered mental state. The boy has no history of previous major illness, and all of his immunizations are up to date. At the boy's last

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visit to his pediatrician 1 month earlier, the mother was told that her son's weight and height were above the 75th percentile for his age.

The boy attends day care, and his mother reports that he has had no recent contact with sick children there. He has a 15-year-old stepbrother. The patient's mother says that she has locked up all harmful chemicals in the house. She reports that no one in the household smokes but says that she believes her stepson has a “new cigarette-like smoke machine” that he has been using late

at night. Upon further questioning, the mother recalls that she noticed an empty vial of fluid on the coffee table but that she did not think much about it at the time.

Physical Examination

The boy's vital signs are as follows:

- Temperature: 36.9°C
- Blood pressure: 104/75 mm Hg
- Pulse: 144 beats/min
- Respiratory rate: 27 breaths/min

Physical examination shows an alert, well-nourished boy in moderate distress. Wheezing is heard in both lungs, and tachypnea is noted. Cardiovascular examination shows significant tachycardia. Abdominal examination shows diffuse tenderness but no rebound or guarding. The boy's pupils are equal, round, and reactive to light. His skin is flushed, particularly on his cheeks. His reflexes are normal, and there are no other significant physical examination findings. Findings on neurologic examination are normal.

Diagnosis

With the presentation of abdominal pain and vomiting, the differential diagnosis must include gastroenteritis, dehydration, volvulus, appendicitis, intussusception, overdose or toxic exposure, and small bowel obstruction. The boy's wheezing could be related to an acute episode of asthma or aspirin overdose, but asthma alone cannot explain his other gastrointestinal symptoms.

When the medical history and social history are taken into account, one potential diagnosis is nicotine poisoning secondary to accidental ingestion of fluid used in electronic cigarettes (e-cigarettes). The boy might have ingested the e-cigarette fluid that his stepbrother left on a table. His wheezing, vomiting, and diarrhea can be explained by the muscarinic effects of nicotine.

Discussion

Disposition and Treatment

The boy was referred to an emergency department because of his multiple episodes of vomiting, tachycardia, and continued symptoms of nicotinic poisoning. The urgent care providers believed that he needed more advanced monitoring and treatment, such as atropine, for the muscarinic symptoms of nicotine poisoning.

Intractable vomiting can be a cause for further care. In addition, muscle aches and soreness can be signs of rhabdomyolysis, which requires escalation of treatment. Nicotine poisoning can also manifest with seizures and

respiratory failure; both scenarios necessitate advanced medical attention.

Management includes but is not limited to treatment of muscarinic and nicotinic symptoms, evaluation of electrolyte abnormalities, and monitoring of renal function. Muscarinic symptoms such as bronchorrhea, diarrhea, and wheezing can be treated with atropine. Seizures should be managed initially with benzodiazepines. For more persistent seizures, phenobarbital can be used.¹

In patients with respiratory failure, intubation is required.² Electrolyte abnormalities such as hyperkalemia, hyperphosphatemia, and hypocalcemia can be present with nicotine poisoning. Hyperkalemia is the most worrisome and should be identified and treated immediately. Acute renal failure can occur secondary to rhabdomyolysis. For this reason, the patient's serum creatinine kinase, electrolyte, and urine myoglobin levels should be carefully monitored. Nicotine poisoning can cause serious permanent consequences if it is not quickly caught and treated.

Electronic Cigarettes and Children

Advertised as the safe alternative to smoking, e-cigarettes have captured the attention of longtime smokers and young people alike. The manufacturers of e-cigarettes claim that their product is less harmful than traditional cigarettes because e-cigarettes do not produce harmful tobacco smoke. Instead, the devices heat up a premixed fluid within a cartridge and generate a rapidly dissipating vapor that the user inhales.

Recent surveys show that the popularity of e-cigarettes has rapidly increased since the early 2000s. The modern form of the e-cigarette was first patented in 2003 by a Chinese pharmacist who came up with the smoking alternative after his father died of lung cancer. By 2007, the product had reached the United States, where it would reproduce its initial success. Between 2010 and 2011, the percentage of e-cigarette users nearly doubled.³ Findings from a December 2015 Gallup survey⁴ show that e-cigarettes have become the second most common form of tobacco consumption after traditional cigarettes. That same survey found that 5.4% of young adults between the ages of 18 and 29 reported that they use e-cigarettes. High school students have a higher usage rate, at 13.4%, according to 2014 data from the Centers for Disease Control and Prevention.⁵

The growing prevalence of e-cigarettes has increased the rates of nicotine poisoning, particularly in the pediatric population. According to the American Association of Poison Control Centers,⁶ the number of reported liquid nicotine exposures increased from 271 in 2011 to 3783

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in 2014. With the increasing use of e-cigarettes in U.S. households, the number of cases of liquid nicotine poisoning involving children will most likely continue to rise. Fatalities from nicotine poisoning from e-cigarettes have been reported. One case involved a toddler who accidentally ingested cartridge fluid,⁷ and another case involved an adult directly injecting the fluid into the bloodstream.⁸

Take-Home Points

The number of nicotine poisoning accidents secondary to e-cigarette use has increased exponentially in recent years. Health-care providers who are acutely aware of the possibility of nicotine overdose can make rapid, life-saving diagnoses. It is crucial to know the red flags for higher levels of care:

- Decreased oxygen saturation
- Increased respiratory work
- Seizures
- Intractable vomiting
- Rhabdomyolysis
- Hyperkalemia
- Hyperphosphatemia
- Elevated serum creatinine kinase level
- Elevated urine myoglobin level

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